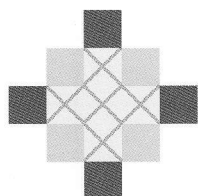


Design Day

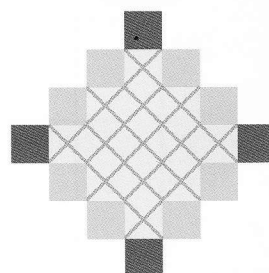
You need: square dot paper

ACTIVITY

- George's class is investigating designs based on patiki patterns used in weaving. George paints blue and green squares around the edges of his designs.



George's first design

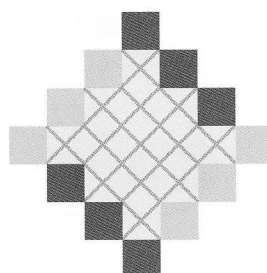


George's second design

- Draw George's third design on square dot paper.
- George predicts that he will paint $4 \times 5 + 4$ squares around the edge of the fifth design. Explain how he made this prediction.
- Use George's rule to predict the number of squares to paint for the twentieth design.
- Complete the table. Show your calculations using George's rule.

Design	Number of painted squares
1st	
2nd	
3rd	
5th	$4 \times 5 + 4 = 24$
37th	
100th	

- Kelly paints the squares around the edges of her designs like this:



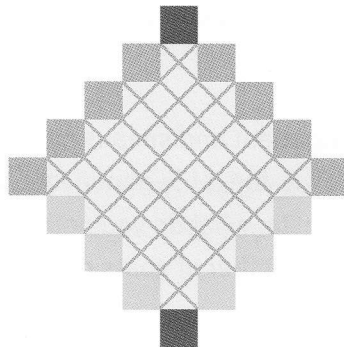
Kelly's second design

- Draw Kelly's first design on square dot paper.
- Kelly predicts that 4×6 squares will need to be painted in the fifth design. Explain her reasoning.

- c. Use Kelly's rule to predict the number of squares to paint in her twelfth design.
- d. Complete the table.
Show your calculations using Kelly's rule.

Design	Number of painted squares
7th	
8th	
	64
47th	
126th	
	800

3. George now decides to paint the squares blue, orange, and green.



George's new third design

- a. Draw George's new second design on dotted paper.
- b. Devise a rule, based on George's designs with 3 colours, for the number of squares to paint in the hundredth design.
- c. Complete the table.
Show your calculations using the rule.

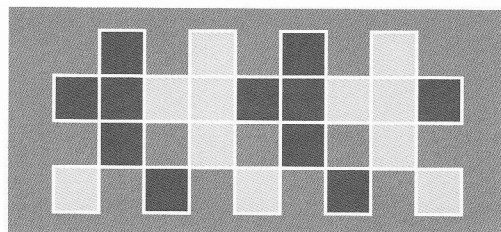
Design	Number of painted squares
5th	
9th	
20th	
37th	
89th	

Frieze

ACTIVITY

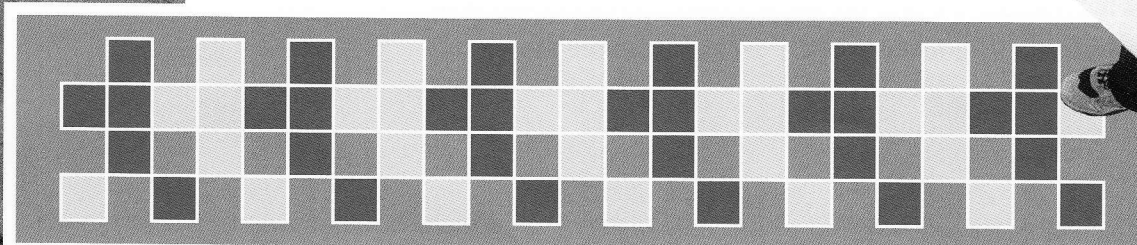
You need: square grid paper

1. Turi makes a design for a wallpaper frieze (a narrow band of decoration) to go around walls just under the ceiling.



She uses a short cut, $4 \times 5 + 2$, to work out the total number of squares in her design.

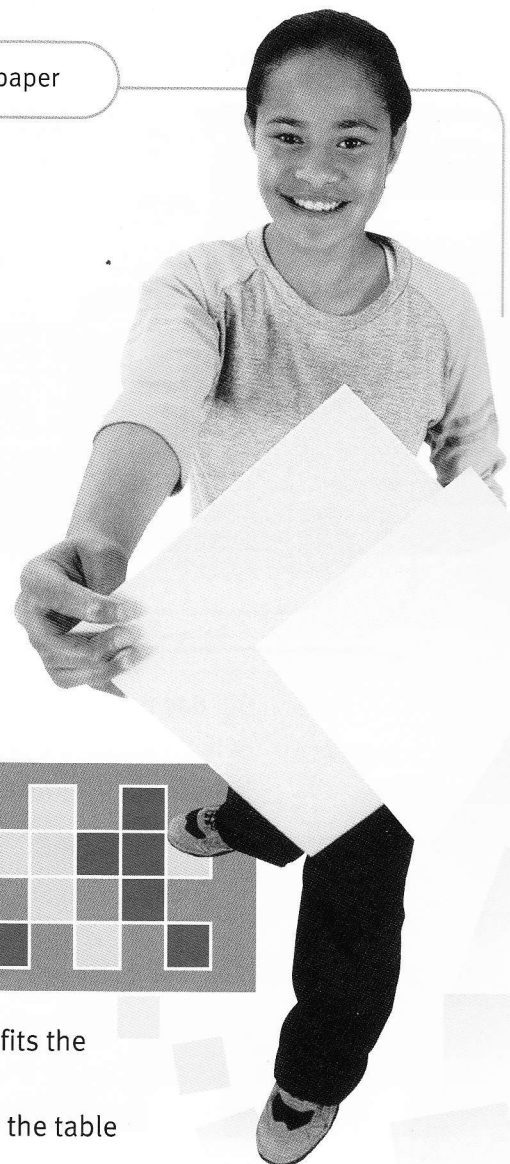
- a. Write Turi's short cut for the total number of squares in the design below.



- b. On square grid paper, draw Turi's design that fits the short cut $6 \times 5 + 2$.
- c. Draw the designs for the last two short cuts in the table below and then complete the table.

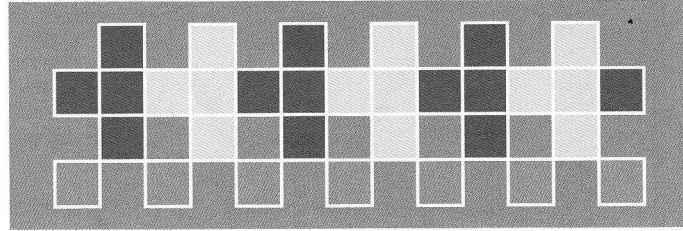
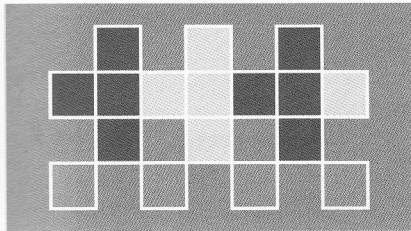
Short cut for number of squares	Total number of squares	Total number of blue squares	Total number of yellow squares
$4 \times 5 + 2$	22		
$6 \times 5 + 2$			
$8 \times 5 + 2$			
$10 \times 5 + 2$			

- d. Look carefully at the table and then predict the total numbers of blue squares and yellow squares in a design with a short cut of $1\,000 \times 5 + 2$.
- e. See if you can predict the total numbers of blue squares and yellow squares in a design with a short cut of $1\,001 \times 5 + 2$. Explain your reasoning.



$$x^2 + a^2 = 10 + 20$$

2. Turi's friend Rory makes a different frieze design.



Look closely at Rory's designs and then complete the tables.

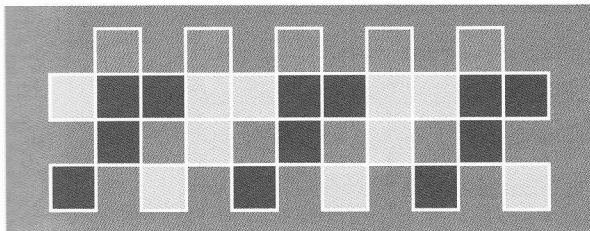
a.

Number of pink squares	Total number of blue and yellow squares
4	$3 \times 4 + 1 = 13$
7	
12	
37	
243	

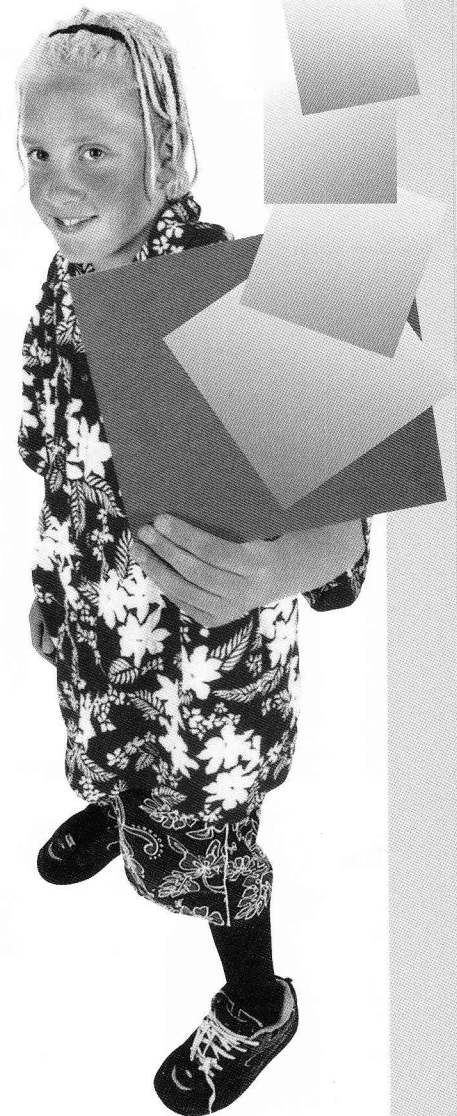
b.

Number of pink squares	Total number of blue and yellow squares
2	$1 \times 4 + 1 = 5$
	29
	73
	97
	301

3. Devise a short cut or rule to help you complete the table for the frieze design below.



Number of pink squares	Total number of blue and yellow squares
5	
4	
10	
15	
256	
	82
	218

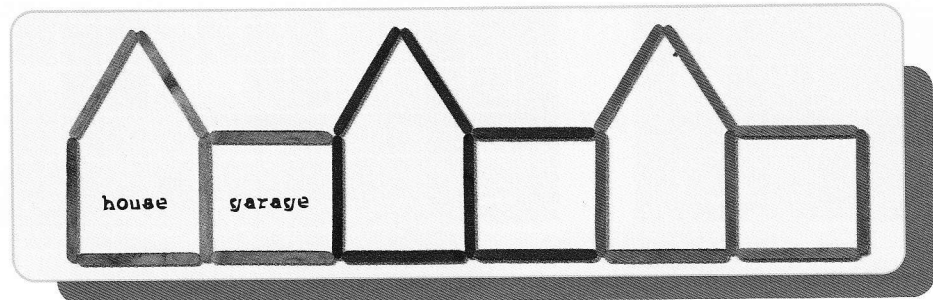


Stick Houses

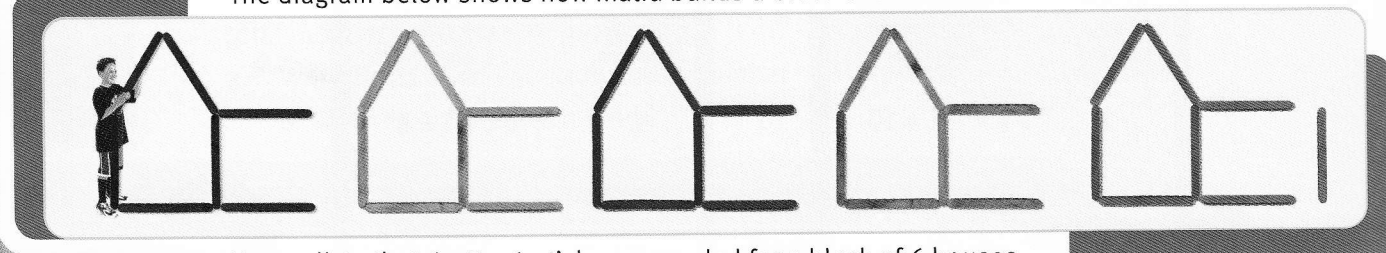
You need: sticks, a calculator (optional)

ACTIVITY

1. Matiu designs blocks of houses with sticks. Each house has a garage.



The diagram below shows how Matiu builds a block of 5 houses.



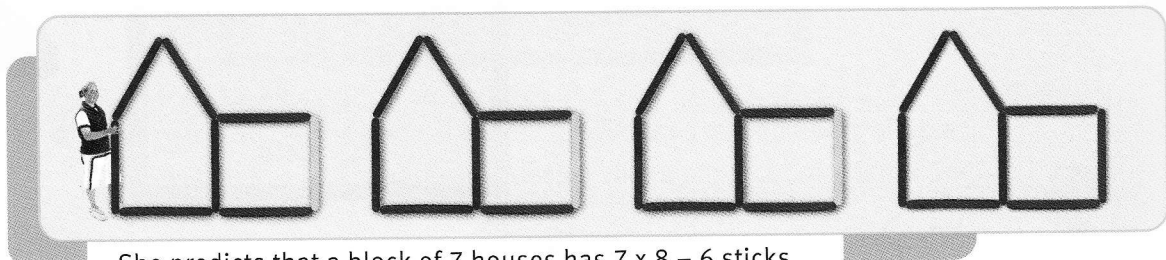
He predicts that $6 \times 7 + 1$ sticks are needed for a block of 6 houses.

- a. Make a block of 6 houses with sticks and check whether Matiu is correct.
- b. Explain how Matiu's short cut works.
- c. Complete the tables below using Matiu's short cut.

Number of houses	Number of sticks
4	
5	
10	
35	
83	
156	

Number of houses	Number of sticks
	15
	43
	78
	141
	841
	1 401

2. Rebecca uses 3 additional sticks coloured yellow to show another short cut.



She predicts that a block of 7 houses has $7 \times 8 - 6$ sticks.

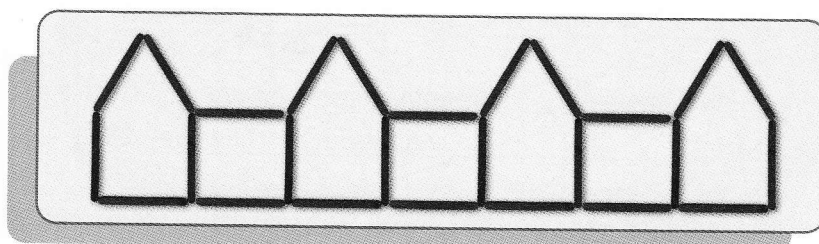
- a. Explain how this short cut works.

- b. Complete the table below using Rebecca's short cut.

Number of houses	Number of sticks
4	
7	$7 \times 8 - 6 = 50$
12	
21	
55	
100	



3. Rebecca makes a new design. The end house doesn't have a garage.

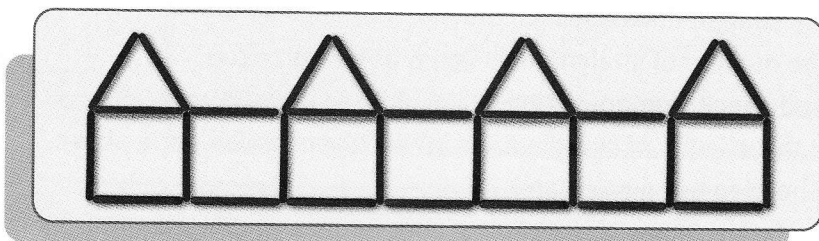


- a. See if you can find two different short cuts for the number of sticks in a block of 6 houses. Explain how each short cut works.
b. Complete the table below.

Number of houses	Number of sticks	
	First rule	Second rule
4		
6		
10		
20		
87		
196		



4. Matiu changes Rebecca's design.



- a. Find a short cut for the number of sticks in this design. Explain how the short cut works.
b. Use your short cut to predict the number of sticks in a block with 100 houses.